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Brief 71-10294

NASA TECH BRIEF

Goddard Space Flight Center

Ray Tracing Program with Options for Diffraction Gratings

The problem:

To devise a ray tracing program capable of tracing rays of any wavelength through surfaces with ruled diffraction gratings. The surfaces may be plane, spherical, conical, or general aspheric polynomial, and the rulings may run in either the X-direction or the Y-direction, where Z is the optical axis. The diffraction may be of any order, positive or negative.

The solution:

Diffraction theory, developed in a vectorial form and coded into ray tracing routines, with options indicating the direction of the grating rulings. The coding is added to SPADE, a Sperry Automatic Design program written in FAP for the IBM-7094 computer, and the coding is written in FORTRAN for a ray tracing program for the CDC-3100 computer.

How it's done:

The convention employed uses a right-hand system of coordinates, and reflection is accomplished by changing the sign of the refraction index of the space following the surface. Rays are treated as unit vectors at refraction. Equations compatible with the sign conventions add the diffraction vector to the refraction (or reflection) vector.

The grating is mathematically generated on the surface by the intersection of a set of parallel planes with the optical surface. The generating planes are in either the X-Z direction or the Y-Z direction, depending on a code introduced with the surface data.

Reference:

Howell, B. J.; A Ray Tracing Program for Crossed Dispersion Systems. Paper presented to Opt. Soc. Amer. (Hollywood, Florida), September 30, 1970.

Notes:

1. This program is written in FORTRAN IV for use on the CDC-3100 computer.
2. Requests for further information may be directed to:

   COSMIC
   Barrow Hall
   University of Georgia
   Athens, Georgia 30601
   Reference: B71-10294

Patent status:

No patent action is contemplated by NASA.

Source: B. J. Howell
Sperry Rand Corporation
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